

Background

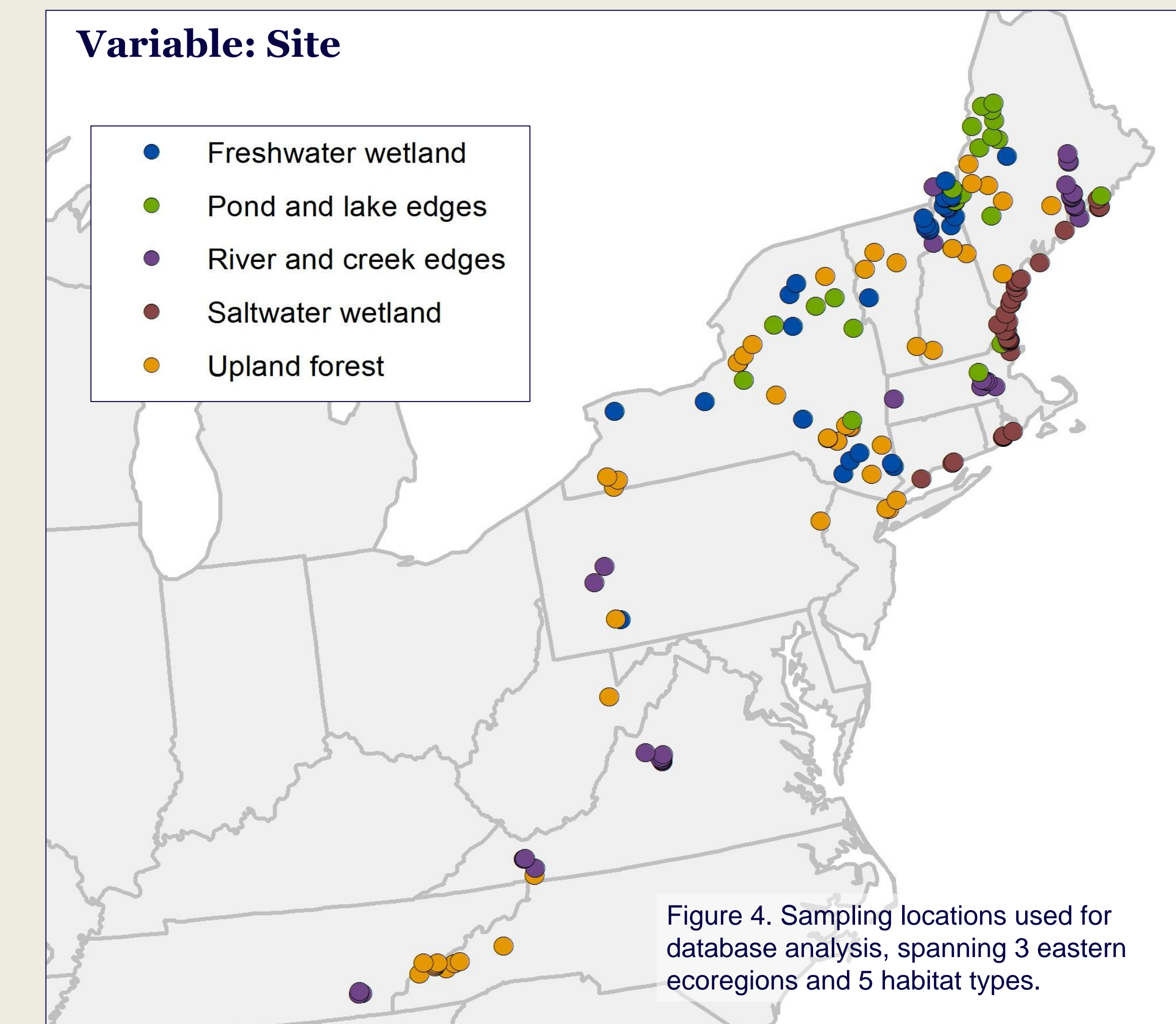
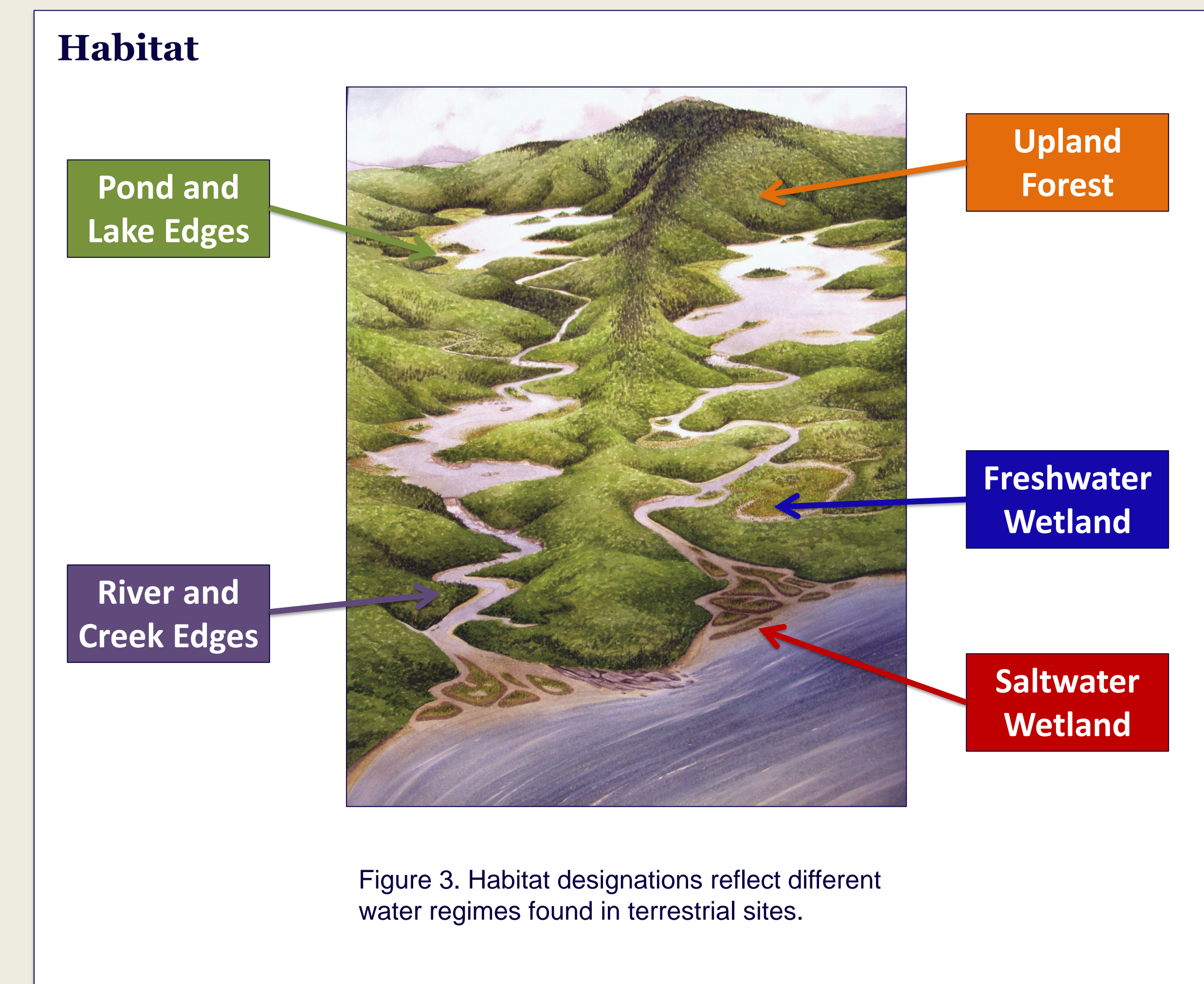
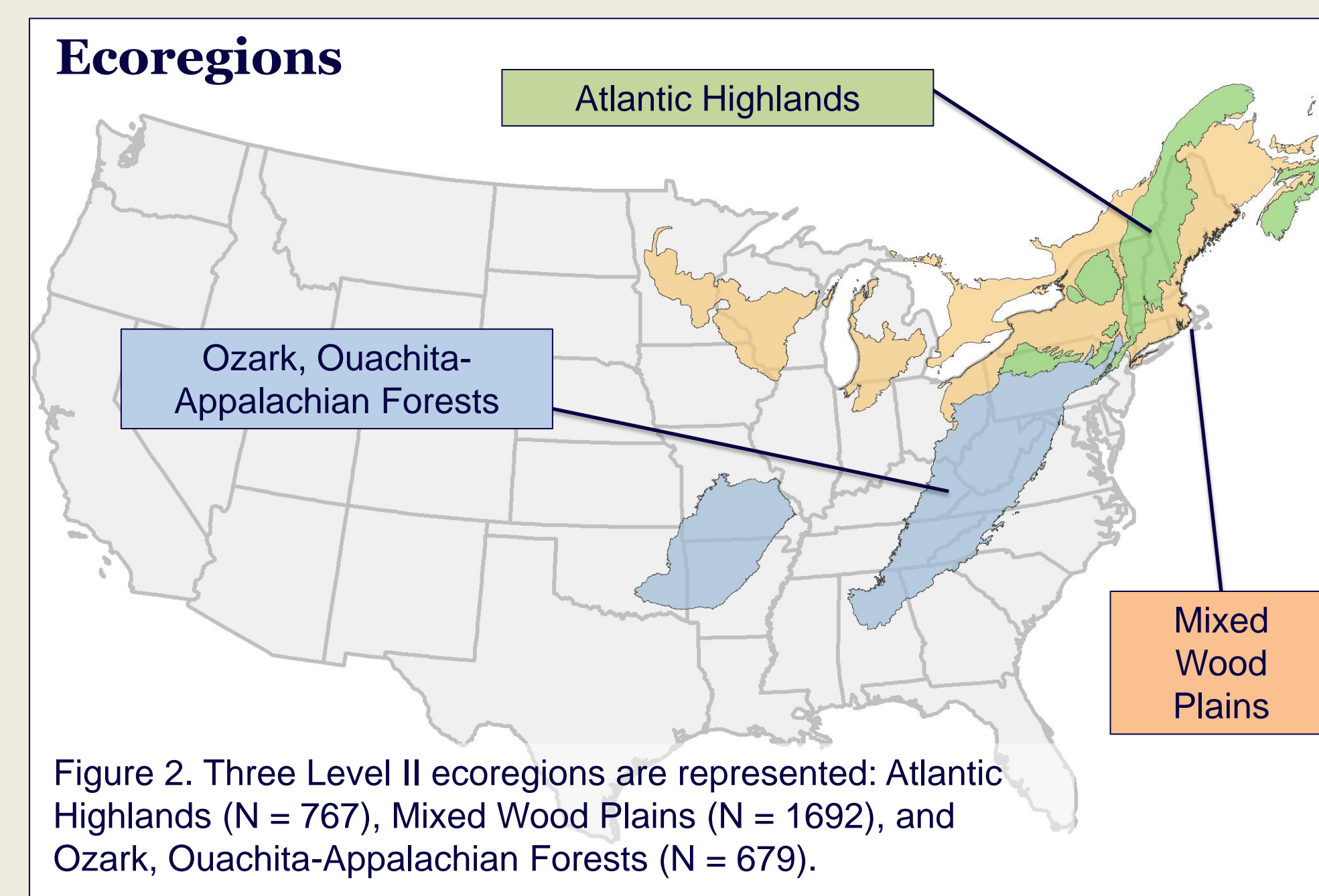
- Mercury (Hg) is a persistent environmental contaminant with wide-ranging effects on human and wildlife health.
- Although Hg must be methylated in wet environments before it can become bioavailable, recent research has shown that terrestrial songbird species feeding on insects near aquatic systems can bioaccumulate Hg at levels similar to or higher than aquatic-foraging species.
- Songbirds are ideal biomonitors of ecological risk to Hg because they are ubiquitous across different habitats and geographic areas, have well-defined foraging ecology and can be more sensitive to mercury than other taxa.
- As part of the Western Mercury Synthesis, led by the U.S. Geological Survey, Biodiversity Research Institute, University of Wisconsin La-Crosse, and Harvard University, we are compiling existing published and unpublished data on songbird Hg exposure across the continental United States, in order to better understand Hg in the western states. This poster summarizes the current state of our database, which we are actively expanding in the next few years as we gain support for this synthesis.

Objectives

- Identify and compile published literature sources that report mercury concentrations in songbird species across North America.
- Conduct a preliminary analysis, using the existing BRI database, to understand what factors drive Hg bioaccumulation in songbirds in the eastern United States, considering both habitat factors and intrinsic species characteristics.
- Compare findings from the northeast to areas with less robust songbird samples, such as the western states.

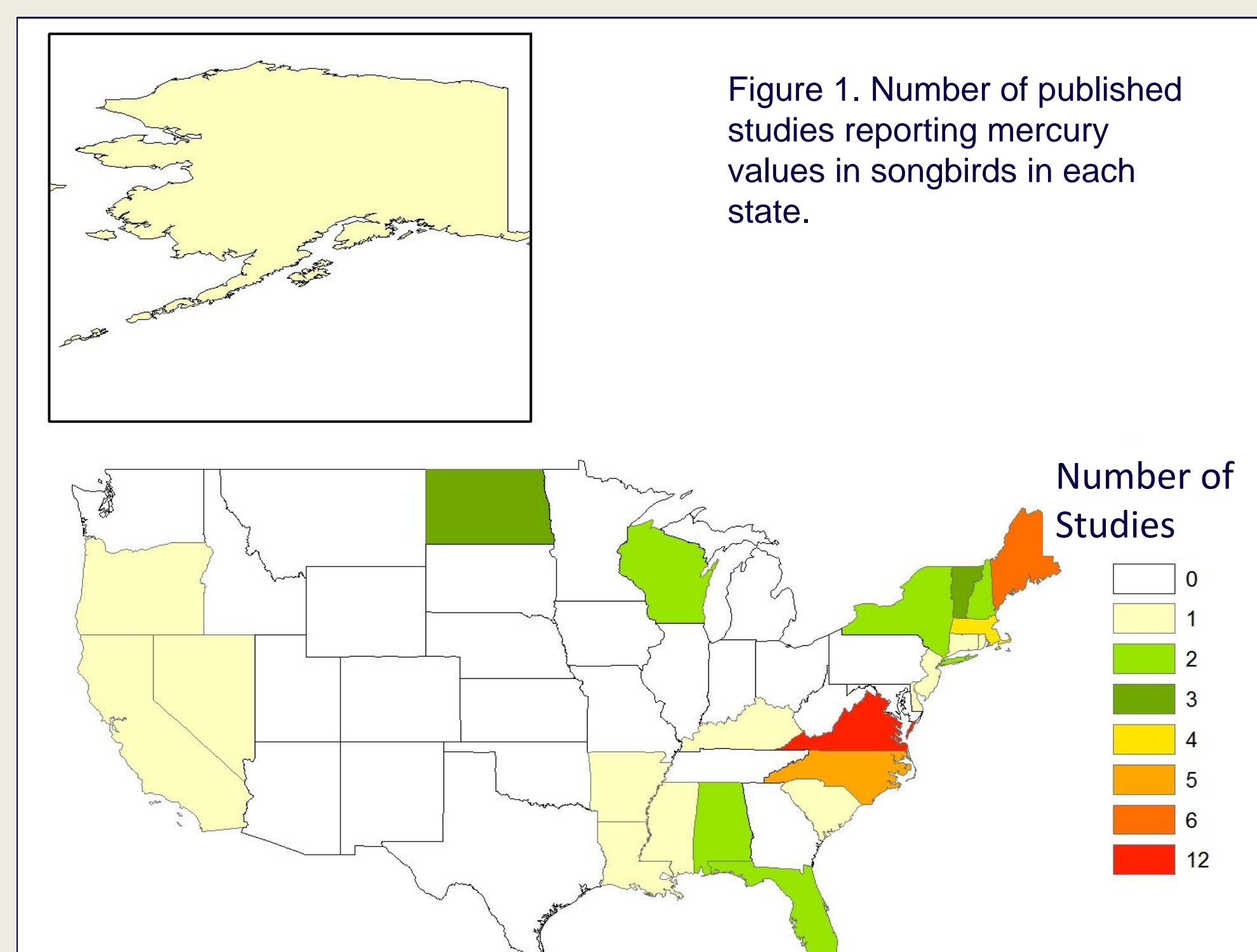
BRI Songbird Database Analysis

Currently, the BRI songbird mercury database contains over 7,000 records across North and Central America from Belize to Alaska. We queried the database to select only ecoregions with greater than 600 samples. We identified 5 variables that are likely to influence mercury bioaccumulation, including main effects of foraging guild (based on De Graaf et al. 1985), ecoregion (Ecological Regions of North America, Fig. 2), and habitat (Fig. 3), and random effects of species and site (Fig. 4).



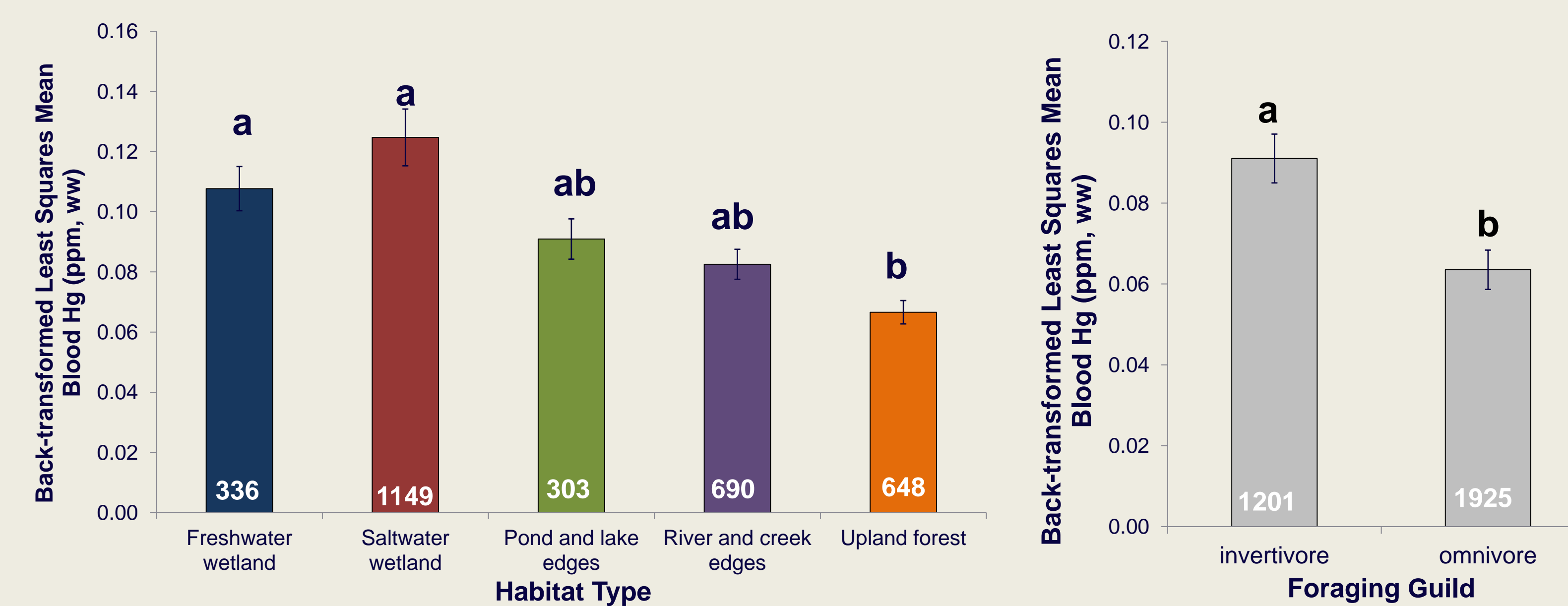
Objective 1 Results. Locations of published papers on mercury in songbirds are skewed to the eastern United States.

We compiled published literature sources, both those identified by previous studies, and the result of a Google Scholar search for “bird and mercury.” We were interested in any paper that reported Hg values for a songbird species (including blood, feather, egg, and nestling or adult tissues). We identified the location of samples within each study and mapped the results in Fig. 1. If a study included bird samples collected across multiple states, we identified all states indicated in the paper.



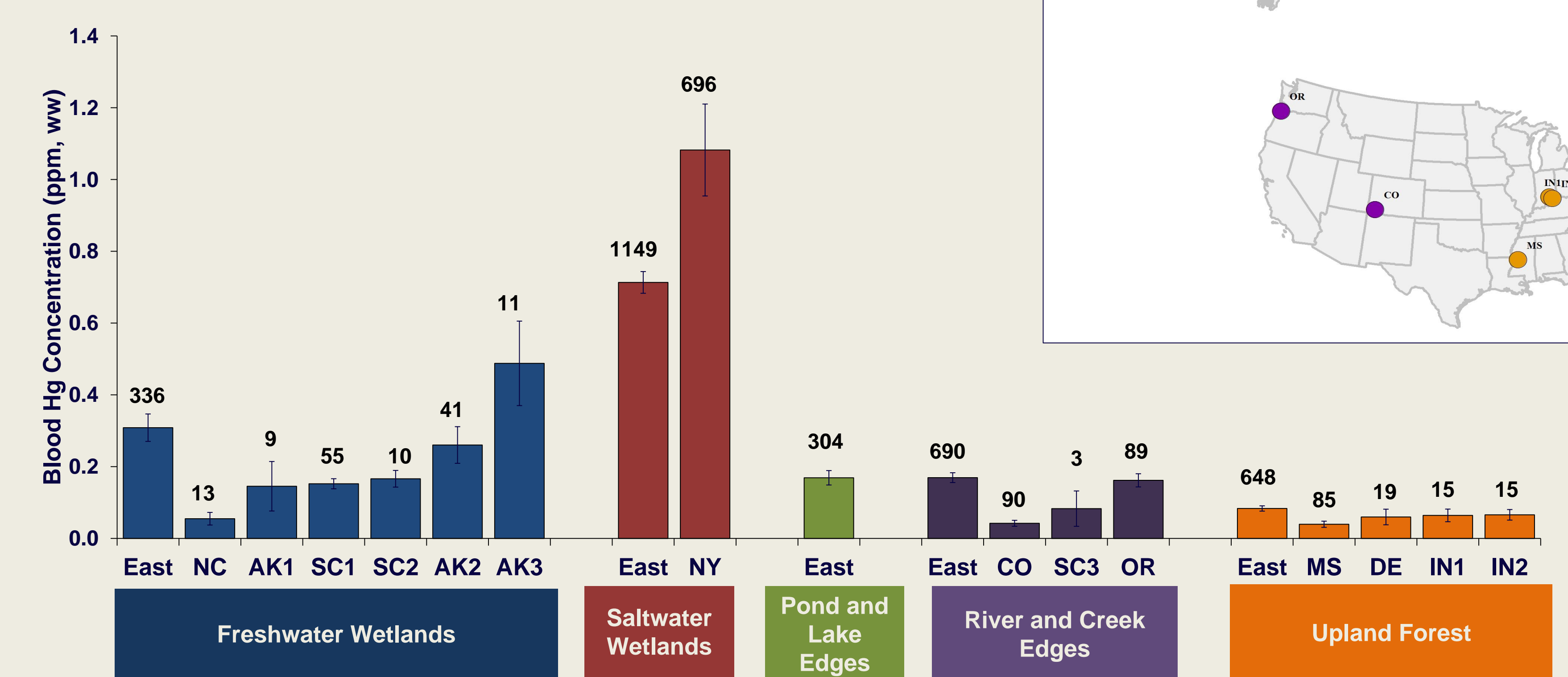
Objective 2 Results. Blood mercury concentrations in the east are influenced by habitat type and foraging guild.

We included 3126 records in our mixed-effects model. We found no significant effect of Ecoregion (ANOVA: $F_{2,185,5} = 1.186$, $P = 0.308$), but significant effects of habitat (ANOVA: $F_{4,212,5} = 3.87$, $P = 0.005$) and guild (ANOVA: $F_{1,91,72} = 5.251$, $P = 0.024$, Fig. 5).



Objective 3 Results. Samples collected from western states have comparable mean mercury values to those collected in the east.

Because we found that habitat and foraging guild affect blood mercury concentration of terrestrial songbirds, we conducted a preliminary analysis of data collected from other geographic areas. Selecting only invertivore species, we compared mean blood mercury concentrations at each site outside of the eastern states (Fig. 6), grouped by habitat type (Fig. 7).



Acknowledgements

This work is the results of many years of fieldwork and collaborations with many folks within BRI and at other organizations. We wish to thank Melissa Duron, Carrie Osborne, Oksana Lane, and Sam Edmonds at BRI for their help with data collection and analysis.

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Literature Cited

De Graaf, R.M., N.G. Tilghman, and S.H. Anderson. 1985. Foraging guilds of North American birds. Environmental Management 9: 493-536.
Ecological Regions of North America. Level I-II. http://www.epa.gov/wed/pages/ecoregions/na_eco.htm

Conclusions

- The majority of literature concerned with mercury in songbirds has been focused in the east.
- In the east, songbird blood mercury is influenced by habitat and foraging guild, but not by ecoregion. Wetland habitats have higher mercury concentrations than upland forest habitats.
- When taking into account foraging guild and habitat type, samples from western states, such as Alaska and Oregon, have similar means to those collected in the east, indicating that atmospheric mercury deposition is likely cause for concern in the west as well.

Future Directions

Overall, our dataset is very site limited at this spatial scale, and more data from different types of sites would likely illustrate more fine-scale differences in Hg bioaccumulation. Through the work being done in the western synthesis Hg project, we hope to incorporate new datasets from the west into this model, to expand the scope of our analysis across the country.

For more information on the Western Hg Synthesis Project, visit <http://www.briloon.org/mercuryconnections/western>